DOCUMENT RESUME

ED 127 961 IR 003 926

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TITLE The Fate of the Dinosaur.
PUB DATE Jul 76
NOTE 14p.; Paper presented at the American Library Association Annual Conference (95th, Chicago, Illinois, July 18-24, 1976)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS Data Bases; History; Information Networks; Information Services; Information Systems; Interlibrary Loans; Library Automation; Library Networks; *Medical Libraries; *National Libraries; On Line Systems; Speeches; Technology; Trend Analysis
IDENTIFIERS ALA 76; *National Library of Medicine; NLM

ABSTRACT

The National Library of Medicine (NLM) had its beginnings in the Library of the Army Surgeon General's office established in 1836. Dr. John Shaw Billings, who was in charge from 1865 to 1895, greatly influenced the growth of the library and also initiated production of the widely used "Index Catalogue" of author and subject listings as well as the monthly "Index Medicus." Since then NLM has introduced microfilm (1937), photoduplication (1942), and the mechanization of "Index Medicus" (late 1950's). In 1960 NLM began developing its computerized Medical Literature Analysis and Retrieval System (MEDLARS) to allow bibliography production and rapid data base searches. The MEDLARS photocomposition techniques proved highly successful and cost-effective. The MEDLARS On-Line (MEDLINE) remote terminal network became a reality in 1971, and now serves 500 institutions nationwide. At present, NLM coordinates a network of 11 regional libraries supported by 125 resource libraries and provides interlibrary loan service for the national medical community. In the future NLM will have to learn to cope with new technology and even larger amounts of material if it wishes to avoid going the way of the dinosaur. (LS)

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THE FATE OF THE DINOSAUR*

Martin M. Cummings

I believe that one must look back before looking ahead especially during a bicentennial year. It is reckless to do otherwise for we learn from the lessons of the past. Most federal libraries have a rich and proud tradition of high quality service to their clients. The National Library of Medicine has a venerable history reaching back into the 19th century--although we're not quite on a first-name basis with the founding fathers as is the Library of Congress. Its origins can be traced to 1836, when it took form as the Library of the Army Surgeon General's Office. In many ways it was analogous to the Federal libraries you represent; not least, perhaps, in its munificent funding--a budget of $150 for the first year.

If it were not for Dr. John Shaw Billings, one of the giants of 19th century medicine, the collection might still be known as the Library of the Surgeon General's Office. Dr. Billings, an Army surgeon, took charge of 1800 volumes in 1865 and, by 1895, when he retired, the collection had grown to 117,000 books and 192,000 pamphlets.

Over the years, as its size and importance increased, the Library underwent several name changes; to Army Medical Library in 1922 and Armed Forces Medical Library in 1952. The present designation, National Library of Medicine, was the result of legislation in 1956 that transferred the Library from the Defense Department to the

*Presented by Martin M. Cummings, M. D., Director, National Library of Medicine, at the Federal Librarians Roundtable, ALA Centennial Conference, July 18, 1976, Chicago, Ill.

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Department of Health, Education, and Welfare.

Since that time, we have acquired a new building and moved from downtown Washington, D. C., to Bethesda, Maryland, on the grounds of the National Institutes of Health. This distance from the center of power has at least one advantage, for our space is not coveted by the Congress. To paraphrase the Bard, it is "a poor thing, sir, but our own."

Dr. Billings not only built a great collection of medical literature, but also conceived of a book catalog that would combine an author and subject listing of the Library's books, dissertations, and pamphlets with a subject listing of the medical articles in its journals. Exactly 100 years ago, in 1876, in what may fairly be described as a prototype "feasibility study," Billings printed a small edition of a Specimen Fasciculus for evaluation by the medical and the library communities. "Should it be published?" he asked. "What is the value of such an index to the people of the United States as compared with an expedition to the North Pole...(or) one company of cavalry...?" A clearer statement of the "guns versus butter" dilemma would be hard to discover.

Physicians and librarians alike responded enthusiastically to Billings' proposed index. Dr. Oliver Wendell Holmes stated that it "would have excited the admiration...of the profession in all centuries." Congress was persuaded to appropriate funds and, after four years of preparation, Billings published Volume I, A to

Berlinski, of the Index-Catalogue of the Library of the Surgeon General's Office. Fifteen years later the alphabetical series was completed with Volume XVI after publishing subject and author entries for about 170,000 books and a half-million journal articles.

The fact that the Index-Catalogue was a library catalog, like that of the British Museum, published in an alphabetical dictionary form, offered both advantages and disadvantages. Publication being constrained by the alphabet, the Catalogue could never be current. This was quite apparent during the second World War, when the thousands of references on malaria resulting from wartime research did not appear until the "M" volume of the Index-Catalogue's Fourth Series was published after the war.

On the other hand, by assembling subject references retrospectively over periods of years, the Index-Catalogue compiled subject bibliographies which greatly facilitated the writing of textbooks and review papers. Thus Sigmund Freud, intending a review paper on cocaine, was at a loss on how to assemble his references until a colleague introduced him to Volume 4, 1883, of the Index-Catalogue, which had recently been received by a library in Vienna. There he found the cumulated references he needed under Erythroxylon (coca).

To complement the alphabetical Index-Catalogue, Billings organized, as a current outlet for the indexing, the Index Medicus: A Monthly Classified Record of the Current Medical Literature of the World.

The first volume appeared in 1879. Adapting as necessary to the vicissitudes of budget, the varying talents and interests of staff, and the ever-changing medical scene, the Index Medicus has continued for almost a century. The Index-Catalogue also has its modern counterpart in the National Library of Medicine Current Catalog, published quarterly.

The hundred years between the Specimen Fasciculus and today have seen a great many changes in our operation. Microfilming began at the Library in 1937, photoduplication in 1942. In 1943 we began interlibrary lending of microfilm in lieu of books, for those who could use it. Twenty-five years later this practice was challenged by a publisher and extensive litigation followed--reaching the highest level of judicial review. A second review of copyright affecting libraries is now underway in the Congress.

Microfilming, primarily for preservation, continues at the rate of two million pages each year. Even so, we are losing the battle against deteriorating material. Ironically, it is not the literature Billings collected whose preservation most concerns us, but the more recent materials, printed on paper with an acid base.

In the late 1950's, aided with a two-year grant from the Council on Library Resources, the National Library of Medicine began to investigate mechanizing the handling of journal article references for publication in Index Medicus. This effort resulted in a significant breakthrough, combining into one operational system: flexowriter composing machines for the index copy, IBM key-punches and sorters for

alphabetizing the copy by author and subject, and a listomatic step-and-repeat camera for composing column-width film. Successful as this was for the publication of Index Medicus, it was quickly evident that a system based on index cards could not serve for rapid search and retrieval.

Beginning in 1960 the Library began developing MEDLARS (Medical Literature Analysis and Retrieval System), a computer-based system that would permit both efficient production of bibliographies and rapid searching of the data base. MEDLARS development took three years and cost $3 million.

One of the most remarkable aspects of the system was the pioneering photocomposition equipment developed for MEDLARS. According to tradition in the Government Printing Office, typesetting the successive volumes of the Index-Catalogue constituted the most formidable and taxing job assigned by any federal executive agency. The equipment developed for the Library was called GRACE (Graphic Arts Composing Equipment), and it was estimated to have the typesetting power of 55 linotype operators. The August 1964 issue of Index Medicus, the first typeset by GRACE, contained 13,733 citations, totaling 9,000,000 characters. It took only 18 hours for the MEDLARS computers to compose it.

Since that August 1964 issue, it is estimated that MEDLARS has produced over 500,000 pages of composed copy. At current typesetting rates that amounts to a staggering $20 million worth of composition.

Actually, less than one-half of this is for Index Medicus. MEDLARS also gives the Library the flexibility to produce a wide range of Recurring Bibliographies in specialty areas. We now produce over 25 specialized bibliographies in such subjects as dentistry, nursing, anesthesiology, hypertension, and toxicity. They are printed and distributed by cooperating government and nongovernment organizations from copy prepared by MEDLARS.

In addition to Index Medicus and the Recurring Bibliographies, we use MEDLARS to prepare Literature Searches--a series of printed bibliographies on topics of current interest. More than 100 titles are now available and read like headings from the daily press, for example: Acupuncture, vinyl chloride, human experimentation, child abuse and malpractice. Literature Searches contain from 50 to 500 citations, and are sent to requestors without charge.

As the MEDLARS data base grows, it becomes an increasingly valuable resource for retrospective and current searchings of the health science journal literature. Today it contains more than 2.5 million references. Searching these citations to answer a specific request has been made much easier since the introduction of MEDLINE (MEDLARS On-Line) in 1971. Previously, each search was formatted by a specialist at the Library and run against the MEDLARS magnetic tapes. MEDLINE now makes it possible for a librarian or health professional to search the data base on a terminal connected by telephone lines to our IBM 370/158 computers in Bethesda.

MEDLINE contains all Index Medicus references for the last 2-3 years (about 500,000). MEDLINE back files contain earlier references, and there are a number of specialized on-line files for toxicology, cataloging information, audiovisual material, and cancer research information. These data bases are accessible from terminals in over 500 institutions around the U.S. and in eight foreign countries. Within this network are about 80 Federal user institutions, some of whom, no doubt, are represented here today.

Indexing is an intellectual challenge. We tend to forget, though, that the index is a means, not an end. The end is to provide the user of our libraries access to the monograph, the journal article or the audiovisual teaching package. Scholars are willing to make pilgrimages, preferably with support from a Federal grant, to unique sources of bibliographic treasures. Scholars, unfortunately, are in a minority. Most of our users are busy people, who want what they want when and where they want it, before they've forgotten why they wanted it.

We can't, nor would we want to, put a National Library of Medicine within ten miles of every potential user. However, we have strengthened the nation's medical libraries through the Medical Library Assistance Act of 1965. NLM now coordinates a network of 11 Regional Medical Libraries. These, in turn, support and are supported by 125 "resource libraries," usually medical school libraries. At the base of the pyramid are the libraries of the nation's 7,000 hospitals, which are the primary entry points into the network for the majority of the

nation's health workers. Only when the materials needed are not available locally are the requests passed up the network. Last year we provided 250,000 interlibrary loans of material not available elsewhere. The regional libraries provided another 500,000 loans. We were able to fill 80 percent of the requests within four calendar days.

I am sure that each of my colleagues could describe his system in equally complacent terms. So could the Librarian of Alexandria. Are there any clouds on the horizon to threaten our serenity? I see three major influences which must inevitably bring about changes in libraries, as we know them.

One is simply the growth of the literature. My predecessor, John Shaw Billings, faced this problem in 1881 when he wrote (in "Our Medical Literature," delivered in London, August 5, 1881 before the International Medical Congress):

> "What will the libraries and catalogues and bibliographies of a thousand, or even of a hundred years hence be like, if we are thus to go on in the ratio of geometric progression, which has governed the press for the last few decades? The mathematical formula which would express this, based on the data of the past century, gives an absurd and impossible conclusion, for it shows that if we go on as we have been going there is coming a time when our libraries

will become large cities, and when it will require the services of every one in the world, not engaged in writing to catalogue and care for the annual product."

When Dr. Billings wrote these prescient words there were perhaps 850 medical journals, publishing some 20,000 articles thought worth noting for Index Medicus. We estimate that there are now 20,000 periodicals in the health field, from which we select 220,000 articles for indexing. A polyglot reader, equally fluent in the 42 languages we cover, attempting to scan all of the articles we index each year, working a normal 8 hour day with two weeks vacation to rest his eyes, would wind up at the end of his first year with 21 years backlog to finish reading one year's literature.

How do we ensure that our users get the information they need before it starts fermenting in the pipe line? It is my belief that there is no greater impetus to change than the force exerted on existing mechanisms by the increasing volume of literature and the difficult task of accessing it.

The second force contributing to change is the spiralling cost of acquiring, processing and disseminating this information. A study recently completed by Dean Bernard Fry and Herbert White of Indiana University reports that libraries are cutting back on journal subscriptions and joining networks, cooperating in acquisitions and increasing interlibrary lending. We observed this as our number of interlibrary loans increase, although we are uncertain whether this

increase is because of declining local journal subscriptions or improved MEDLINE services. Fry showed that book purchases suffer even more than journal subscriptions. The ratio of books to serials in academic, public and special libraries has been dropping steadily from two to one in 1969 to 1.6 to one in 1973. Hours of service, and staff are reduced. Earlier this year, New York City ordered eight branch libraries closed for lack of money. The National Library of Medicine is caught in this same budget squeeze of having to acquire increasing volumes of increasingly expensive materials. Unavoidably, we too have contributed to this dilemma for medical libraries. For example, our friendly local printer, the Government Printing Office, sold Cumulated Index Medicus, an indispensable reference work in 1965 for $40. Ten years later the cost is now almost $200.

The third force contributing to change is information technology itself. New technology is not only an impetus to change; it is, I believe, the only hope of salvation for the library community. Technology, if wisely managed, will not only allow us to cope with the increasing amounts of published information and the rising costs associated with acquiring and disseminating this information, but will also allow us to offer new and better services.

Having said this, let me issue a caveat. Technological prediction is a risky business. In 1963 the Library of Congress reported, in "Automation and the Library of Congress" the results of a two-year,

$100,000 study conducted by some of the Nation's leading technical specialists, advised by four distinguished librarians. These experts reported that the central bibliographic operations of the Library of Congress could be automated--hardware, software and necessary file conversion--for about $30 million. The survey team omitted the Card Division from their deliberations on the grounds that automation would eliminate the necessity for card catalogs, at least within the Library of Congress. Need I remind you that this same Card Division subsequently produced MARC, which has become a de facto international standard for automated bibliography!

At NLM our computer system does not end with MEDLINE. We are exploring the uses of computers in such areas as cataloging, in serials control, in coordinating network-wide acquisitions, and in the verification and routing of interlibrary loan requests.

Computers and communications work well together. A transcontinental, and intercontinental, communications network made MEDLINE economically feasible. Our Lister Hill Center has worked with a variety of communication modes: using NASA's communication satellites for health care delivery in Alaska and experimenting with a split medical school campus, with part of the entering class in Seattle and another in Fairbanks, Alaska. We have constructed a two-way microwave television network to tie together the medical schools and hospitals of Dartmouth and the University of Vermont with three community hospitals. We have distributed computer assisted educational

materials from two central computers to 100 using institutions. These communication experiments have completely by-passed the traditional printed media.

Our efforts in developing and applying computer and communications technology will receive a great boost when the new Lister Hill National Center for Biomedical Communications building is constructed next to the Library. This new facility will contain modern laboratories for developing and testing new communication modalities. Also to be housed in the new building are the Library's National Medical Audiovisual Center, now in Atlanta, our Extramural Grants Programs, the MEDLARS computers and our Specialized Information Services.

We look forward to a future where the cost of computers and communication services is steadily decreasing, where the costs of acquiring conventional library materials are steadily increasing, where the printed word is being supplemented with audiovisual and computer-based educational materials, with users accustomed to the speed and convenience of electronic communication becoming increasingly dissatisfied with the traditional leisurely pace of libraries and publishers. Libraries of the future will bring information to the homes and working places of the user through a national communications network. The picture telephone will replace the parking lot and the computer terminal will replace the card catalog. Because of the high cost of printing, scientific literature

will be published in abstract form with libraries holding and providing the full text upon request. This is as far as I dare look into the future.

I believe that we at the National Library of Medicine have a clear vision of where we want to go, and what it will take to get there. I am not as sanguine about the information community as a whole, however, for there is still a reluctance by some to adopt new and proven methods. Whether we like it or not, we are entering a decade that will see great changes in the way libraries do business. If we are to shape these changes, and not be shaped by them, we must accept the benefits of the new technologies and plan intelligently to use them.

The dinosaur was a superbly efficient form of life, with one unfortunate handicap. It could not adapt to rapidly changing conditions. When the conditions changed, the dinosaur died. I am confident that the library community, using the many talents to be found within it will avoid the fate of the dinosaur, and not be found frozen over a clutch of addled eggs that nobody wants. I am also confident that your national libraries, with your support and assistance, will not be replaced by institutions whose primary interests are related to profit taking rather than public service. Our experience and efforts of the past century have laid a solid base for continued accomplishments in the next century. We simply need to continue to plan carefully and realistically and work to serve our users and not ourselves.